

REMARKS

Claims 1-15 are currently pending. Claims 1-3, 5-8, and 11-15 are amended. Applicants request reconsideration of claims 1-15 in view of the above amendments and the following remarks.

Claim Objections

The Office Action has objected to claims 11-15 due to the following informalities: the term “machine-readable medium” in claims 11-15 should be “computer readable storage medium”. Applicants respectfully traverse the objection. In one embodiment of the invention, the machine-readable medium may include a mechanism that provides information in a form readable by a machine such as computer or digital processing device (See lines 10-12 of page 5 of the specification). The processor device may also be a signal processor in another embodiment of the invention (See lines 31-32 of page 5 of the specification).

Since the machine as described in the specification encompasses more than just a computer, Applicants respectfully submit to the Office that claims 11-15 should not be limited to a “computer readable storage medium”, but rather, be directed to a machine-readable storage medium as amended herein in the specification. Therefore, Applicants respectfully request the Office to withdraw the objection of claim 11. Claims 12-15 are dependent on claim 11 and therefore are patentable as being dependent on the allowable base claim 11 (MPEP2143.03).

Claim Rejections – 35 USC § 101

The Office Action has rejected claims 1-15 under 35 U.S.C 101, as being directed towards non-statutory subject matter. In particular, the Office has adopted the “useful, tangible, and concrete result” inquiry in determining if claims 1-15 are directed towards non-statutory subject matter.

Applicants respectfully submit that the “useful, tangible, and concrete result” inquiry is inadequate to determine if claims 1-15 are directed towards non-statutory subject matter and the machine-or-transformation test outlined by the Supreme Court is the proper test to apply (See *In re Bilski*, No. 2007-1130, 2008 U.S. App. LEXIS 22479, Fed. Cir. Oct. 30, 2008). According to *In re Bilski*,

“To be sure, a process tied to a particular machine, or transforming or reducing a particular article into a different state or thing, will generally produce a “concrete” and “tangible” result as those terms were used in our prior decisions. But while looking for “a useful, concrete and tangible result” may in many instances provide useful indications of whether a claim is drawn to a fundamental principle or a practical application of such a principle, that inquiry is insufficient to determine whether a claim is patent-eligible under § 101. And it was certainly never intended to supplant the Supreme Court’s test. Therefore, we also conclude that the “useful, concrete and tangible result” inquiry is inadequate and reaffirm that the machine-or-transformation test outlined by the Supreme Court is the proper test to apply.”

Applicants respectfully submit that claim 1 recites processing the received speech signals to generate a plurality of phoneme clusters, i.e., the received speech signals are transformed into a plurality of phoneme clusters, and therefore fulfils the machine-or-transformation test as outlined by the Supreme Court. As such, Applicants respectfully request the Office Action to withdraw the rejection of claims 1, 6 and 11 as the “useful, tangible, and concrete result” inquiry is inadequate to determine if claims 1, 6 and 11 are directed towards non-statutory subject matter. Claims 2-5 are dependent on claim 1, claims 7-10 are dependent on claim 6 and claims 12-15 are dependent on claim 11 and

therefore are patentable as being dependent on the allowable base claims (MPEP2143.03).

The Office has also cited that claims 11-15 are drawn to a "signal" *per se* as recited in the preamble, and as such, is directed towards non-statutory subject matter (See page 4 of the Office Action). Applicants have amended the specification to remove the reference of the machine-readable storage medium to a signal. Therefore, Applicants respectfully submit that claims 11-15 are now directed towards statutory subject matter and requests the Office to withdraw the rejection of claims 11-15.

Claim Rejections – 35 USC § 103 (*Kao* in view of *Alleva*)

The Office Action has rejected claims 1-15 under 35 U.S.C 103(a), as being unpatentable over U.S. Patent No. 6,317, 712 issued to Kao et al, hereinafter referred to as "*Kao*" and in view U.S. Patent No. 5,794,197 issued to Alleva et al, hereinafter referred to as "*Alleva*".

In order to establish *prima facie* case of obviousness, the Supreme Court in KSR International Co. v. Teleflex Inc., 550 U.S. ___, ___, 82 USPQ2d 1385, 1395-97 (2007) identified a number of rationales to support a conclusion of obviousness which are consistent with the proper "functional approach" to the determination of obviousness as laid down in Graham. One of the rationales includes combining prior art elements according to known methods to yield predictable results. To reject a claim based on this rationale, Office personnel must resolve the Graham factual inquiries. Then, Office personnel must articulate the following:

(1) a finding that the prior art included each element claimed, although not necessarily in a single prior art reference, with the only difference between the claimed invention and

the prior art being the lack of actual combination of the elements in a single prior art reference;

(2) a finding that one of ordinary skill in the art could have combined the elements as claimed by known methods, and that in combination, each element merely performs the same function as it does separately;

(3) a finding that one of ordinary skill in the art would have recognized that the results of the combination were predictable; and

(4) whatever additional findings based on the Graham factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

Claim 1 as amended herein, recites:

1. A speech processing method comprising:

processing received speech signals to generate a plurality of phoneme clusters;

grouping the plurality of phoneme clusters into a first cluster node and a second cluster node, wherein the first cluster node comprises at least one phoneme cluster from the plurality of phoneme clusters; and

determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster in the first cluster node belonging to the second cluster node instead of belonging to the first cluster node.

(Emphasis added)

Claim 1 is directed to a speech processing method of determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first

cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node belonging to the second cluster node instead of belonging to the first cluster node.

The rule-based decision tree approach and the data driven approach are two popular approaches in building a decision tree-based hidden markov model (HMM). The rule-based decision tree approach uses a set of simple or composite phonetic context questions (questions requiring simple "yes" or "no" answers) as a set of rules to construct a HMM state decision tree according to a maximum likelihood (ML) principle. By way of contrast, the data driven approach groups triphones using specific training data obtained during a training process (See last paragraph of page 1).

A disadvantage of the rule-based decision tree approach is that there is no fairness guaranty for each individual rule regardless if it is derived by a linguistic expert, a database, or by both. That is, for simple phonetic context question based rules, all triphones are grouped into two yes/no classes according to their phonetic contextual information. However, some of the triphones, contrary to the rule, may have a better maximum likelihood (ML) criteria in another class (See first paragraph of page 2).

The data driven approach can provide better guarantees for optimal ML classification for known triphones (i.e., triphones that are obtained during the training process). A disadvantage of the data driven approach, however, is that the tree built with the data driven approach has problems dealing with triphones that did not appear during the training process, but do appear in the recognition process. Consequently, unknown triphones, which were not detected during the training process, may lower speech recognition accuracy (See first paragraph of page 2).

In one embodiment of the invention, higher speech recognition accuracy can be achieved by reshuffling phoneme clusters between first node cluster and a second node cluster based on the likelihood increase, in particular, by controlling a threshold, a decision tree that can ensure optimal maximum likelihood (ML) can be generated with any combination of a rule-based approach and a data driven approach under a unified decision tree structure based on ML principles (See second paragraph of page 3). Therefore, it is important to have a speech processing method of determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node belonging to the second cluster node instead of belonging to the first cluster node as recited in the limitations of claim 1.

Kao, on the hand, describes, a method of phonetic modeling using an acoustic decision tree (rule-based decision tree). *Kao* describes that the triphones are clustered by a decision tree with left/right questions based on triphone acoustics and the split context questions are phonological questions to split the root into two descendent nodes where one answer is “yes” and the other answer is “no” (See lines 47-54 of column 3).

The Office acknowledges that *Kao* does not explicitly teach the limitation recited in claim 1 of determining automatically if a phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node from being in the first cluster node to being in the second cluster node (See lines 1-4 of page 6 of Office Action). *Kao* does not teach or suggest the limitation recited in claim 1, as amended herein, of determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first

cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node belonging to the second cluster node instead of belonging to the first cluster node.

In contrast, claim 1 recites a speech processing method of determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node belonging to the second cluster node instead of belonging to the first cluster node.

Alleva, similarly, does not describe the limitation recited in claim 1 of determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node belonging to the second cluster node instead of belonging to the first cluster node.

Alleva describes a method to create a senone tree for each state of each phoneme encountered in a data set of training words. Each node of the tree beginning with the root node is divided into two nodes by asking linguistic questions regarding the phonemes immediately to the left and right of a central phoneme of a triphone. At a predetermined point the tree creation stops, resulting in leaves representing clustered output distribution known as senones (See line 64 of column 3 to line 7 of column 4). From the description of *Alleva*, it is clear that *Alleva* is describing the rule-based decision tree.

The Office alleges that *Alleva* teaches determining automatically when the at least one phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node from being

in the first cluster node to being in the second cluster node (See lines 5-10 of Office Action). In particular, the Office has construed that step 56 described by *Alleva* of dividing the root according to question with greatest entropy decrease, teaches the limitation recited in claim 1.

Applicants respectfully submit to the Office that the Office has mischaracterized step 56 described by *Alleva*. *Alleva* describes in that in order to split the root node or any subsequent node, the trainer must determine which of the numerous linguistic questions is the best question for the node and the best question is determined to be the question that gives the greatest entropy decrease between the parent node and the children node (See lines 4-9 of column 6). In step 54 of figure 2 as described by *Alleva*, the entropies of each linguistic question regarding left and right adjacent phonemes are calculated and in step 56, the training method divides the root node according to **whichever question yields the greatest entropy decrease (See lines 49-51 of column 6).** Therefore, it is clear that *Alleva* seeks to use the best question to split the root node or any subsequent node in step 56.

Applicants respectfully submit that *Alleva* does not teach or suggest the limitation recited in claim 1, as amended herein, of determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first cluster node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node belonging to the second cluster node instead of belonging to the first cluster node. *Kao* as described earlier also does not teach or suggest the limitation in claim 1, as amended herein, of determining subsequent to grouping the plurality of phoneme clusters, when the at least one phoneme cluster in the first cluster

node is to be moved into the second cluster node based on a likelihood increase of the phoneme cluster of the first cluster node belonging to the second cluster node instead of belonging to the first cluster node.

The combination of *Alleva* with *Kao* does not cure the deficiencies of these references. Therefore, there is no *prima facie* case of obviousness as both *Kao* and *Alleva* fail to teach at least one element of the limitation recited in claim 1, as stated in Graham factual inquiries. Applicants respectfully request the Office to withdraw the rejection of claim 1. Independent claims 6 and 11 similarly recite the same limitation in claim 1. All the arguments presented earlier for claim 1 apply fully to claims 6 and 11. Claims 2-5 are dependent on claim 1, claims 7-9 are dependent on claim 6 and claims 12-15 are dependent on claim 11, therefore these dependent claims are patentable as being dependent on the allowable base claims. (MPEP2143.03)

Conclusion

Applicants respectfully submit that the rejections have been overcome by the amendment and remark, and that the claims as amended are now in condition for allowance. Accordingly, Applicants respectfully request the rejections be withdrawn and the claims as amended be allowed.

Invitation for a Telephone Interview

The Examiner is requested to call the undersigned at (503) 439-8778 if there remains any issue with allowance of the case.

Request for an Extension of Time

The Applicants respectfully petition for extension of time to respond to the outstanding Office Action pursuant to 37 C.F.R. § 1.136(a) should one be needed. Please charge the fee under 37 C.F.R. § 1.17 for such extension to our Deposit Account No. 02-2666.

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

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